IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:

Hidefumi Niki et al. Group Art Unit: 2872

Serial Number: 10/731,289 Examiner: LAVARIAS, ARNEL C

Filed: December, 9, 2003

For: ROLL OF POLYVINYL ALCOHOL FILM AND POLARIZING FILM PREPARED THEREFROM

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
Washington, D.C. 20231

Sir:

Toshiyuki Edazawa residing at 4-47-8, Minamiwakamori, Ogaki-shi, Gifu 503-0977 Japan duly deposes and says:

1. That he graduated from Department of Applied Chemistry, Faculty of Engineering, NAGOYA INSTITUTE OF TECHNOLOGY, Aichi, Japan, in the year 1991;

2. That since 1991, he has been employed in the capacity of The Nippon Synthetic Chemical Industry Co., Ltd.;

3. That from 1991 he has been engaged in research and development for PVOH (poly (vinyl alcohol)) film.;

4. That he has read and is familiar with the instant application for United States Letters Patent and Office Action thereto mailed August 2, 2006; and

5. That he made experiments (Examples and Comparative Examples disclosed in experimental part of the instant specification) in

order to show that the present invention can provide the PVA film roll which is useful as a polarizing film only when the cylindrical core tube satisfies subject matters in Claim1, namely, aluminum core tube having a roundness of 0.01 to 0.2 mm, cylindricality of 0.01 to 1 mm and surface roughness of at most 100 S (100 μm).

Examples and Comparative Examples

All % in following examples are by weight unless otherwise noted. And the unit "S" of a surface roughness is a maximum height (μm) when measured in an optional region of 8 mm.

EXAMPLE 1

An aqueous solution of polyvinyl alcohol resin having a solid concentration of 45 % (including plasticizer and releasing agent as solid matters) was prepared using a polyvinyl alcohol resin having an average degree of polymerization of 1,700 and a degree of hydrolysis of 99.7 % by mole, glycerol as a plasticizer and polyoxyethylene alkylamine as a surfactant (releasing agent). The solution was cast from a T-die onto a dram roll in the form of a thin film and dried, followed by heat-treatment and humidity-conditioning, to give a polyvinyl alcohol film having a water content of 4 %.

The polyvinyl alcohol film was subsequently wound up around an aluminum cylindrical core tube having the following properties under the following conditions.

Aluminum cylindrical core tube

Diameter (outer diameter): 165 mm

Length of cylinder: 2.7 m

Roundness: 0.07 mm

Cylindricality: 0.05 mm

Surface roughness: 35 S

Winding conditions

Contact pressure of guide roll (touch roll) with core tube: 150 N/m

Winding tension: 130 N/m

Winding speed: 80 m/minute

The roll of the polyvinyl alcohol film was then unwound at a rate of 1.23 m/minute. After swelling the film in a water bath for washing at 24°C, the film was uniaxially stretched 1.8 times in an iodine bath (20°C, iodine 0.17 g/liter) and 1.7 times in a boric acid bath (50°C, iodine 12 ppm, boric acid 47 g/liter), and further uniaxially stretched 4.6 times in total at a winding speed of 5.6 m/minute to give a polarizing film.

EXAMPLE 2

A polyvinyl alcohol film having a water content of 4 % was prepared in the same manner as in Example 1.

The polyvinyl alcohol film was subsequently wound up around an aluminum cylindrical core tube having the following properties under the same conditions as in Example 1.

Aluminum cylindrical core tube

Diameter (outer diameter): 165 mm

Length of cylinder: 2.9 m

Roundness: 0.10 mm

Cylindricality: 0.09 mm

Surface roughness: 30 S

The roll of the polyvinyl alcohol film was unwound, treated and uniaxially stretched 4.6 times in total in the same manner as in Example 1 to give a polarizing film.

EXAMPLE 3

A polyvinyl alcohol film having a water content of 4 % was prepared in the same manner as in Example 1.

The polyvinyl alcohol film was subsequently wound up around an aluminum cylindrical core tube having the following properties under the same conditions as in Example 1.

Aluminum cylindrical core tube

Diameter (outer diameter): 114 mm

Length of cylinder: 2.2 m

Roundness: 0.05 mm

Cylindricality: 0.08 mm

Surface roughness: 35 S

The roll of the polyvinyl alcohol film was unwound, treated and uniaxially stretched 4.6 times in total in the same manner as in Example 1 to give a polarizing film.

EXAMPLE 4

A polyvinyl alcohol film having a water content of 4 % was prepared in the same manner as in Example 1.

The polyvinyl alcohol film was subsequently wound up around an aluminum cylindrical core tube having the following properties under the same conditions as in Example 1.

Aluminum cylindrical core tube

Diameter (outer diameter): 165 mm

Length of cylinder: 3.3 m

Roundness: 0.1 mm

Cylindricality: 0.09 mm

Surface roughness: 35 S

The roll of the polyvinyl alcohol film was unwound, treated and uniaxially stretched 4.6 times in total in the same manner as in Example 1 to give a polarizing film.

COMPARATIVE EXAMPLE 1

A polyvinyl alcohol film having a water content of 4 % was prepared in the same manner as in Example 1.

The polyvinyl alcohol film was subsequently wound up around a cylindrical core tube having the following properties made of a plastic (polyvinyl chloride) under the following conditions.

Plastic cylindrical core tube

Diameter (outer diameter): 165 mm

Length of cylinder: 2.7 m

Roundness: 0.8 mm

Cylindricality: 1.2 mm

Surface roughness: 40 S

Winding conditions

Contact pressure of guide roll (touch roll) with core tube: 150 N/m

Winding tension: 130 N/m

Winding speed: 80 m/minute

The roll of the polyvinyl alcohol film was unwound, treated and uniaxially stretched 4.6 times in total in the same manner as in

Example 1 to give a polarizing film. The film roll could not be stably unwound due to wrinkles formed when winding the film, so uniform stretching could not be achieved.

COMPARATIVE EXAMPLE 2

A polyvinyl alcohol film having a water content of 4 % was prepared in the same manner as in Example 1.

The polyvinyl alcohol film was subsequently wound up around a cylindrical core tube having the following properties made of a paper under the following conditions.

Paper cylindrical core tube

Diameter (outer diameter): 153 mm

Length of cylinder: 1.6 m

Roundness: 1.2 mm

Cylindricality: 1.5 mm

Surface roughness: 40 S

Winding conditions

Contact pressure of guide roll (touch roll) with core tube: 150 N/m

Winding tension: 130 N/m

Winding speed: 80 m/minute

The roll of the polyvinyl alcohol film was unwound, treated and uniaxially stretched 4.6 times in total in the same manner as in Example 1 to give a polarizing film. The film roll could not be stably unwound due to wrinkles formed when winding the film, so uniform stretching could not be achieved.

COMPARATIVE EXAMPLE 3

A polyvinyl alcohol film having a water content of 4 % was prepared in the same manner as in Example 1.

The polyvinyl alcohol film was subsequently wound up around an aluminum cylindrical core tube having the following properties under the following conditions.

Aluminum cylindrical core tube

Diameter (outer diameter): 165 mm

Length of cylinder: 2.7 m

Roundness: 1.1 mm

Cylindricality: 1.3 mm

Surface roughness: 120 S

Winding conditions

Contact pressure of guide roll (touch roll) with core tube: 150 N/m

Winding tension: 130 N/m

Winding speed: 80 m/minute

The roll of the polyvinyl alcohol film was unwound, treated and uniaxially stretched 4.6 times in total in the same manner as in Example 1 to give a polarizing film. However, breaking of the film frequently occurred when stretching the film since the edge portions of the film were folded to cause blocking, so no polarizing film was obtained.

The polyvinyl alcohol films and polarizing films obtained in the Examples and Comparative examples were evaluated according to the following methods. The results are shown in Table 1.

Presence of wrinkles

The polyvinyl alcohol films wound up 1,000 m was visually observed with respect to presence of wrinkles and evaluated according

to the following criteria.

○: Formation of wrinkles is not observed.

×: Formation of wrinkles is observed.

Uneven dyeing

The polarizing films were visually observed with respect to uneven dyeing and evaluated according to the following criteria.

○: Uneven dyeing is not observed.

×: Uneven dyeing is observed.

Polarizing properties

The simplex percent transmission and degree of polarization of the polarizing films were measured by a spectrocolorimeter (model Σ90 made by Nippon Denshoku Kogyo Kabushiki Kaisha) at five positions in the transverse direction and the respective average values were obtained.

Table 1

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Com. Ex. 1	Com. Ex. 2	Com. Ex. 3
Polyvinyl alcohol film (before being wound up)							
Thickness (μm)	75	75	75	75	75	75	75
Cylindrical core tube							
Material	Al	Al	Al	Al	plastic	paper	Al
Diameter (mm)	165	165	114	165	165	153	165
Length (m)	2.7	2.9	2.2	3.3	2.7	1.6	2.7
Roundness (mm)	0.07	0.1	0.05	0.1	0.8	1.2	1.1
Cylindricality (mm)	0.05	0.09	0.08	0.09	1.2	1.5	1.3
Surface roughness	35S	30S	35S	35S	40S	40S	120S
Polyvinyl alcohol film							
Presence or absence of wrinkles	○	○	○	○	×	×	×
Uneven dyeing	○	○	○	○	×	×	×
Polarizing property							
Transmission (%)	42.7	42.8	42.7	42.9	42.6	42.4	-*
Degree of polarization (%)	99	99.2	99.1	99.1	97.6	96.8	-*

* No polarizing film was obtained due to breaking of film.

As shown in Table 1, the polyvinyl alcohol film rolls obtained in the examples were good in winding state and had no wrinkle, so polarizing films free of uneven dyeing and having excellent optical properties were obtained therefrom.

In contrast, the polyvinyl alcohol film rolls obtained in the comparative examples had wrinkles, so unwinding was not stabilized and uniform stretching was not achieved. Thus, uneven dyeing occurred and the obtained polarizing films had lower optical properties. In particular, in Comparative Example 3, breaking of the film frequently occurred at the time of stretching the film, so a polarizing film was not obtained.

Comparing Examples of the present invention with Comparative Example 3, even though the same aluminum core tube is used, in Example 3 where the surface roughness thereof is 120 S (120 μm) that is out of the range specified in the present invention, a film obtained by using the roll has wrinkles and unevenness of dyeing, and also when the film is drawn in order to obtain polarizing film, the edge part is broken due to winding unevenness and wrinkles, which cause blocking, and breakage is frequently occurred during drawing the film, and as a result, a polarizing film cannot be obtained. As apparent from the Comparative Examples 1 and 2, these core tubes made of pulp or plastics cannot give the PVA film roll having desired properties, although surface roughness and roundness thereof satisfy elements of Claim 1

As explained above, only by winding up the PVA film around a cylindrical core tube made of aluminum having a specific roundness,

cylindricality and surface roughness, the wound PVA film roll becomes to be useful.

Therefore, a polarizing film prepared from such a polyvinyl alcohol film roll has an excellent polarizing property, since uneven stretching and uneven dyeing do not occur in the dyeing and stretching steps in the production of polarizing films.

The undersigned declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

This 31st day of October, 2006

by Toshiyuki Edazawa

Toshiyuki Edazawa

We, the undersigned witnesses, hereby acknowledge that Toshiyuki Edazawa is personally known to us and did execute the foregoing Declaration in our presence on:

Date: October 31, 2006 Witness Toshihiro Shimizu

Date: October 31, 2006 Witness Syuichi Kitamura